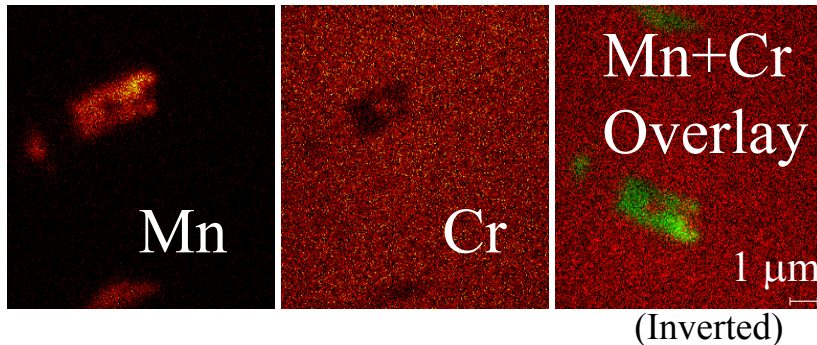


Combined Secondary Ion Mass Spectrometry, Cathodoluminescence Spectroscopy, and Chemical Processing

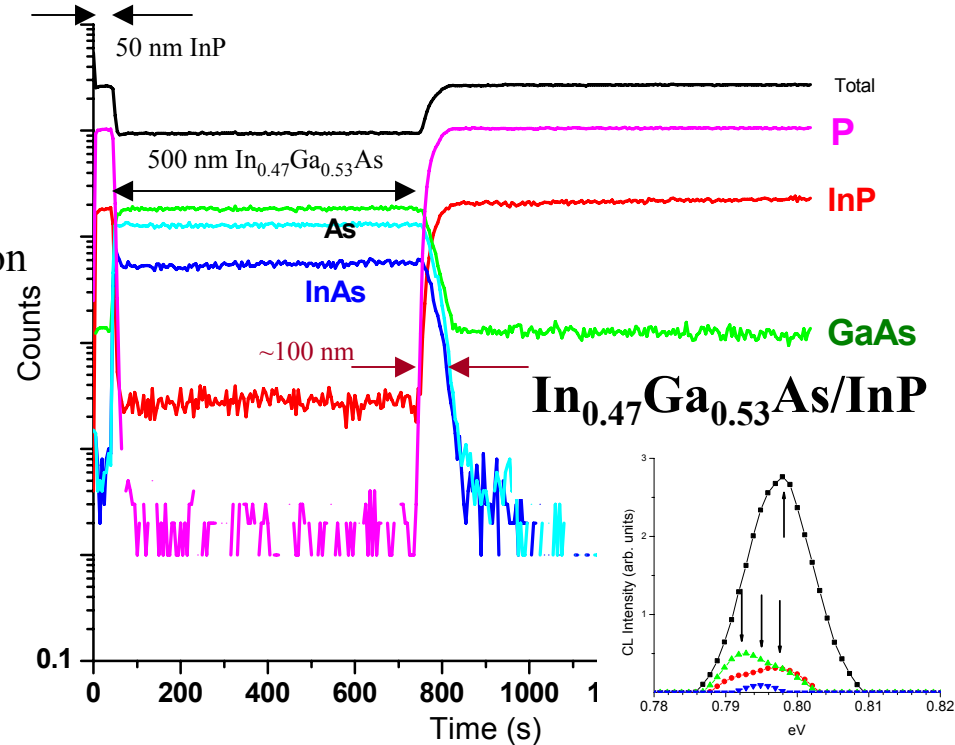
Leonard J. Brillson, Ohio State University, DMR-0079438

Recent Activities

The distribution of chemical species on or below the surface of many solid materials can have profound effects on electronic, chemical, and mechanical properties, even when present in only trace amounts. We have developed instrumentation to detect atomic species imbedded in solids and correlate this information on a sub-micron scale, both topographically and in depth, with localized and extended electronic structures.



Positive SIMS ion images show Mn precipitates in 304 stainless steel with uniform Cr. The Cr “shadow” overlaps precisely with the Mn image, showing no Cr depletion near Mn to within 100nm.



Nm-scale interface layers depend on specifics of MBE growth process (above). P vs. As compete for In with intentional anion overlap, broadening deeper vs. shallower junction. Spatially-resolved CL (lower right) shows band edge variations associated with this ultrathin composition change.

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Education, Outreach, and Mentoring

Major Research Instrumentation for combined secondary ion mass spectrometry (SIMS), cathodoluminescence spectroscopy (CLS), chemical processing and growth is now available for research and training as a unique national resource. Students work on projects that lead to publications in peer reviewed journals and stimulate grad school education. SIMS/CL classroom training facilitates student participation. A visiting scientist program promotes research collaborations across the country.



Research is done by undergraduates and graduate students on state-of-the-art instrumentation. In figure above, undergrad Charlie Wickersham (center), grad student Michael Hetzer (sitting), and research scientist Stephen Goss prepare to transfer sample from MBE process chamber into SIMS analysis chamber. At left, time-of-flight electrostatic analyzer and 100 nm focused ion guns join to UHV MBE growth and process chamber.

